REMARKS/ARGUMENTS

This application has been carefully reviewed in light of the Office Action dated October 1, 2007. Claims 1 to 4, 7 to 12, 14 to 16 and 18 to 37 are pending in the present application, with Claims 1, 11, 15, 19, 26 and 30 being in independent form. By this response, no claims have been added, amended or cancelled. Reconsideration and allowance are respectfully requested.

Claim Rejections – 35 USC § 103

Claims 1-3, 8-12, 14-16, 18-21, 25, 26, 30 and 34 are rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over U.S. Patent Application Publication No. 2002/0127978 (Khatri) in view of U.S. Patent Application Publication No. 2003/0123381 (Zhuang); and Claims 22-24, 27-29 and 31-33 are rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over Khatri in view of Zhuang and further in view of U.S. Patent No. 6,611,231 (Crilly). Reconsideration and withdrawal of these rejections are respectfully requested.

Independent Claim 1 generally concerns a method of performing spatial processing at a receiver in a wireless multiple-input multiple-output (MIMO) communication system. The system includes obtaining a plurality of received symbol streams for a plurality of data symbol streams sent via a plurality of spatial channels of a MIMO channel in the wireless MIMO communication system, wherein spatial processing is performed at a transmitter with steering vectors, which are estimates of transmitter steering vectors required to orthogonalize the plurality of spatial channels. The method further includes receiving orthogonal pilot transmissions from a plurality of antennas at the transmitter, and obtaining an estimate of a channel response matrix for the MIMO channel, wherein the estimated channel response matrix is obtained based on the received orthogonal pilot transmissions. In addition, the method includes performing spatial processing on the plurality of received symbol streams with a spatial filter to obtain a plurality of filtered symbol streams, which are estimates of the plurality of data symbol streams, wherein the spatial filter has a response that is derived based on a minimum mean square error (MMSE) criterion that minimizes mean square error between the plurality of filtered symbol streams and the plurality of data symbol streams.

Thus, among its many features, Claim 1 provides that spatial processing is performed at a transmitter with steering vectors, which are estimates of transmitter steering vectors required to orthogonalize the plurality of spatial channels. The applied references of Khatri, Zhuang and

Crilly are not seen to disclose or suggest at least this feature.

As understood by Applicant, Khatri discloses that in OFDM systems, different sub-streams are sent at different carrier frequencies, the spacing of which are such that they are orthogonal and can be distinguished at the receiver. See Khatri, paragraph [0032]. Khatri is further seen to disclose the transmission of K separate sub-streams into K different directions, and the reception of multipath signals from J distinct directions. See Khatri, paragraph [0034]. In addition, Khatri is seen to disclose use of a matrix A, which is an M x J matrix whose columns are the steering vectors $a(\Omega_j)$ for the directions Ω_j into which the J sub-streams are to be transmitted. See Khatri, paragraph [0051].

The Office Action is seen to equate Khatri's sub-streams with the claimed spatial channels. However, Khatri is not seen to disclose or suggest that its sub-streams are orthogonal. Rather, Khatri is merely seen to disclose that the spacing of different carrier frequencies can be orthogonal.

The Office Action at page 4 also directs attention to transfer matrix H at paragraph [0056] of Khatri. In particular, the Office Action contends that a transfer matrix H of Khatri is determined using a training sequence, and that training sequences sent with the sub-streams are orthogonal to one another.

Applicant respectfully submits that even if Khatri's training sequences can be orthogonal (a point which Applicant does not concede), Khatri is still not seen to disclose or suggest that its sub-streams are orthogonal. As noted above, Khatri is merely seen to disclose the transmission of K separate sub-streams into K different directions; Khatri is not seen to disclose or suggest orthogonalizing those K sub-streams.

Accordingly, Khatri is not seen to disclose or suggest that spatial processing is performed at a transmitter with steering vectors, which are estimates of transmitter steering vectors required to orthogonalize the plurality of spatial channels.

In addition, Zhuang and Crilly have been reviewed and are not seen to compensate for the deficiencies of Khatri vis-à-vis Claim 1. In particular, Zhuang and Crilly are not seen to disclose or suggest that spatial processing is performed at a transmitter with steering vectors, which are estimates of transmitter steering vectors required to orthogonalize the plurality of spatial channels.

Claim 1 is therefore believed to be allowable over the art of record.

Independent Claims 11 and 15 contain limitations similar to Claim 1 discussed above. Accordingly, these claims are believed to be allowable over Khatri, Zhuang and Crilly for at least the same reasons as Claim 1.

Independent Claim 19 generally concerns a method of performing spatial processing at a transmitter in a wireless multiple-input multiple-output (MIMO) communication system. The method includes obtaining a plurality of data symbol streams for transmission on a plurality of spatial channels of a MIMO channel in the wireless MIMO communication system, and obtaining an estimate of a plurality of steering vectors, wherein the plurality of steering vectors is based on received orthogonal pilot transmissions. The method further includes performing spatial processing on the plurality of data symbol streams with the plurality of steering vectors, one steering vector for each data symbol stream, to obtain a plurality of transmit symbol streams for transmission from a plurality of transmit antennas. The plurality of steering vectors are estimates of transmitter steering vectors required to orthogonalize the plurality of spatial channels. The plurality of data symbol streams are recovered at a receiver with a spatial filter having a response derived based on a minimum mean square error (MMSE) criterion that minimizes mean square error between a plurality of filtered symbol streams from the spatial filter and the plurality of data symbol streams.

Thus, among its many features, Claim 19 provides that the plurality of steering vectors are estimates of transmitter steering vectors required to orthogonalize the plurality of spatial channels.

The applied references of Khatri, Zhuang and Crilly are not seen to disclose or suggest at least this feature, for reasons similar to those discussed above relative to Claim 1.

Claim 19 is therefore believed to be allowable over the art of record.

Independent Claims 26 and 30 contain limitations similar to Claim 19 discussed above. Accordingly, these claims are believed to be allowable over Khatri, Zhuang and Crilly for at least the same reasons as Claim 19.

The other claims currently under consideration in the application are dependent from the independent claims discussed above and therefore are believed to be allowable over the art of record for at least the same reasons. Because each dependent claim is deemed to define an additional aspect of the invention, however, the individual consideration of each on its own merits is respectfully requested.

Allowable Subject Matter

Claims 4 and 7 have been indicated as being allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Applicant thanks the Examiner for the indicated allowable subject matter. Applicant has not rewritten these claims in independent form at this time, as all claims in the application are believed to be in condition for allowance, as discussed above.

CONCLUSION

Therefore, for at least the reasons presented above with respect to all of the pending claims subsequent to entry of this response, Applicants assert that all claims are patentably distinct from all of the art of record. All objections and rejections having been addressed, it is respectfully submitted that this application is in condition for allowance and a Notice to that effect is earnestly solicited. If any points remain in issue that the Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned at the telephone number listed below.

Charge Statement: For this application, the Commissioner is hereby authorized to charge any required fees or credit any overpayment to Deposit Account 17-0026.

Respectfully submitted,
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Date: February 19, 2008

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